

alone. There are several kindred processes worked at present, amongst which I must notice that of the Autotype Company. In their process an exceedingly thin layer of gelatine is formed on the plate and hardened by means of gum resins. The gelatine is not removed from the plate, but it is printed from whilst still on it. The film is hardened from the back. The glass plate can be inked in as described for the heliotype process, and can be pulled in a lithographic press or in an ordinary printing-press. M. Thiel, of whose process we have beautiful examples on the walls of this room, uses an ordinary lithographic printing-press.

I have only been enabled to give you a brief outline of these few processes, specimens of all of which are to be found in this exhibition. Short as have been the descriptions, I hope, however, that they have been sufficient to enable you to see the immense strides in the methods of producing prints that have been made in the last dozen years. When we consider that the autotype, the Woodbury type, and all the other mechanical printing processes have been worked out in that time, you will see that the inventive faculties of those who labour in the art-science have not been allowed to lie dormant. Perhaps in no other occupation is there such a field for discovery and improvement as in photography; and considering the many workers in it, and the large industry it represents, we may surely hope that in 1886 we may again be able to record a still further advance; it may be, perhaps, in the line I have already indicated, and in colour pictures.

OUR ASTRONOMICAL COLUMN

THE COMET OF 1686.—This comet, so far as the European observations are concerned, offers a very similar case to that of the comet of 1533, for which two totally different orbits have long appeared in our catalogues. As regards the latter, it was shown by Olbers that the observations of Apian between July 18 and 25 were insufficient to decide whether the true direction of motion was in the order of signs or the opposite, the node at the commencement of Leo or the end of Capricornus, or the perihelion in Cancer or in Scorpio; but the publication of the Chinese observations since Olbers wrote, has afforded evidence which tends to give the preference to his direct orbit, as already intimated in this column. The best observations of the comet of 1686, are those of Père Richaud at Pau, on four mornings between September 7 and 15; from his positions for the 7th, 10th, and 15th, the following orbit was obtained, and for the sake of comparison Halley's orbit, the only one previously computed, is copied.

	New Orbit.	Halley's Orbit.
Perihelion Passage, G. M. T. ...	Sept. 19 ^h 20 ^m 46 ^s ...	Sept. 16 ^h 06 ^m 63 ^s ...
Long. of Perihelion ...	23° 35' 4" ...	77° 0' 5" ...
" Ascending Node ...	149 13' 2" ...	350 34' 7" ...
Inclination ...	32 10' 1" ...	31 21' 7" ...
Log. Perihelion Distance ...	9.48730 ...	9.51188 ...
Motion.	Retrograde.	Direct.

If we compare these two sets of elements with Richaud's places, we find the differences between calculation and observation to be, for 16h. Paris M.T., as assumed time—

	New Orbit.		Halley's Orbit.	
	Long.	Lat.	Long.	Lat.
Sept. 6 ...	0 0 ...	0 0 ...	+0 11 ...	-0 32 ...
" 8 ...	-1 18 ...	+0 11 ...	-0 27 ...	0 0 ...
" 9 ...	-0 26 ...	+0 14 ...	+1 32 ...	-1 3 ...
" 14 ...	0 0 ...	0 0 ...	-0 8 ...	-0 4 ...

So that from these eight days' observations only it would be difficult to give a decided preference to either orbit. But it fortunately happened that before the comet was seen in Europe, it had been a very conspicuous object in more southern latitudes; at Para, in Brazil, it had been observed during the whole month of August, the nucleus as bright as stars of the first magnitude, with a tail 18° in length; in Siam by the French Jesuit missionaries, who fixed its position approximately between August 17 and 23, and at Amboyna on August 15, a little south of the belt of Orion.

On comparing the two orbits with the Siam observations, it is at once evident that they decide in favour of Halley's

elements, and on making a further calculation in which the August positions, which are only rough ones, are introduced, the following orbit finally results :—

Perihelion Passage, 1686, September 15 ^h 8 ^m 24 ^s G. M. T.	
Longitude of Perihelion ...	75 58' 4" } Equinox
" Ascending Node ...	354 3' 8" } of 1686.
Inclination ...	34 55' 7" ...
Log. Perihelion Distance ...	9.52636 ...
Motion ...	Direct.

On the morning of August 17 the comet was distant from the earth 0.316, and at the time of Richaud's last observation, 0.973.

While writing on a cometary subject, we are reminded of what appears to be an unusual dearth of comets not of known period, in these parts of the system since the last one was detected by M. Borrelly on December 6, 1874, or more than eighteen months ago. It is true that generally the weather during this interval has been abnormally bad for such work as comet-hunting; still considering that several of the observers who of late years have given most attention to the search for these bodies, are located in very favoured climates, this appears hardly to explain the absence of any discovery. It may be anticipated that a systematic search for comets in the southern heavens will soon be organised by some zealous amateur in the other hemisphere; it is certain that he would in this way be likely to render material assistance in the advancement of cometary astronomy, and as we have before urged, he might succeed in bringing to light again one or two comets which were assuredly moving in elliptical orbits of short periods when last observed, but from one cause or another have since got adrift, and are not so likely to be recovered in the northern as in the southern hemisphere.

NEW MINOR PLANET.—M. Leverrier's *Bulletin International* of July 13 notifies the discovery by M. Paul Henry, at the Observatory of Paris, on the previous evening, of another small planet in R.A. 15h. 56m., N.P.D. 111° 59'. This planet, which is estimated 12.5m., is called No. 164, but it is to be remembered that we do not know the actual positions of so many as 164 of these bodies, and until the elements of any newly-detected one are well determined, there is the chance of identity with one or other of several which have been previously observed and even calculated, but for want of continuous observation are now lost.

A PHYSICAL SCIENCE MUSEUM

THE President of the Royal Society, Dr. Hooker; Mr. Spottiswoode; Dr. Burdon Sanderson; and Dr. Siemens, had an interview on the 17th inst. with the Lord President of the Council, the Duke of Richmond and Gordon, and presented the subjoined memorial from gentlemen who have been connected with the Loan Collection of Scientific Apparatus at South Kensington. His Grace discussed the subject of the proposed permanent Science Museum with the deputation, and stated that he would consult his colleagues.

MY LORD DUKE,

We, the undersigned, beg to submit for your Grace's consideration the importance of establishing a Museum of Pure and Applied Science; that is to say, a Museum to contain Scientific Apparatus, Appliances, and Chemical Products, illustrating both the history and the latest developments of Science; where the methods and results of investigations which have marked important stages in the advancement of Science may be studied, and where also the most highly perfected instruments of the day may be found.

Among the various advantages which in our opinion would accrue from the establishment of such an Institution,

we would mention the following. Investigators would be saved much time and labour by being enabled to see how far, and by what processes, others have advanced in the line of research which they may be pursuing: thus leading them to a knowledge of the facts and laws already established. From an educational point of view such a collection would assist teachers, by enabling them to select, or by showing them how to construct, the best apparatus for illustrating the subjects of their lessons. Great benefit would also accrue to the constructors of Mechanical and Philosophical Apparatus from being able to refer to the original Apparatus which they might be required to reproduce or to improve. To every one connected with Experimental Science, it would be of great service to see the actual instruments, many of which could otherwise be only known to them by description, and, under proper supervision and instruction to learn their actual manipulation and performance. We would also contemplate lending to investigators, under suitable restrictions, such instruments as might be profitably employed in the researches they were pursuing.

In considering this subject our attention has naturally been directed to the existing Museum of Patents. While fully recognising the value of many of the objects now belonging to that collection, we are of opinion that, as standing alone and purely as subjects of a patent, their value is far less than if they formed part of a general collection, and were placed in juxtaposition with instruments of a similar nature, some of which, though not patented, are better adapted to their purpose, and of greater instructional value. The object of a Scientific Museum is the promotion of knowledge, and the establishment of the scientific principles which must underlie all invention; and it would not only prove of great advantage to both scientific investigators and the public if the two objects could be combined in one undertaking, but we believe that the objects of a Patent Museum would be better served by a museum of the character here proposed than by a special collection, such as has hitherto subsisted. We are decidedly of opinion that the state of knowledge in reference to any invention would be only very imperfectly represented by the exhibition of patented instruments and products only.

In support of the views which we have ventured to submit, we would draw your Grace's attention to the Fourth Report of the Royal Commission on Scientific Instruction, §§ 80-94. In § 93 the Commission state:—"We accordingly recommend the formation of a Collection of Physical and Mechanical Instruments; and we submit for consideration whether it may not be expedient that this Collection, the Collection of the Patent Museum, and of the Scientific and Educational Department of the South Kensington Museum should be united and placed under the authority of a Minister of State."

We understand that the Royal Commission for the Exhibition of 1851 has offered to erect a building for the purpose contemplated in this memorial, and we would desire to point out that the purchase of objects need not entail any large outlay of public money. We contemplate the gradual formation of a collection of such objects as might be voluntarily left at the close of the existing Loan Collection, and others which might be contributed from the existing Patent Museum and other public departments, from the parliamentary grants administered at the request of Government by the Royal Society, and from such private societies and individuals as might be disposed to avail themselves of the Museum as a depository of scientific apparatus, appliances, and chemical products.

We have the honour to be, my Lord Duke,

Your Grace's obedient Servants,

(Signed) J. D. Hooker, President of the Royal Society.

John Evans, F.R.S., Chairman of the Conferences in the Geographical Section.

E. Frankland, F.R.S., Chairman of the Conferences in the Chemical Section.
 J. Burdon Sanderson, F.R.S., Chairman of the Conferences in the Biological Section.
 C. W. Siemens, F.R.S., Chairman of the Conferences in the Mechanical Section.
 W. Spottiswoode, Treasurer and Vice-President R.S., Chairman of the Conferences in the Physical Section.
 Charles Brooke, F.R.S.
 Alfred S. Churchill, Chairman of the Society of Arts.
 William Kitchen Parker, F.R.S.
 H. W. Bristow, F.R.S., Director of the Geological Survey of England.
 William B. Carpenter, F.R.S.
 Latimer Clark, late President Soc. Tel. Engineers.
 W. H. Flower, F.R.S., Conservator Hunterian Museum.
 J. H. Gilbert, F.R.S.
 Robert Main, F.R.S., Radcliffe Observer.
 Fredk. Jno. Evans, V.P.R.S., Capt. R.N., Hydrographer of the Navy.
 P. de M. Grey Egerton, F.R.S.
 Hampton, F.R.S., President of the Institute of Naval Architects.
 Joseph Prestwich, F.R.S.
 T. M. Goodeve, M.A.
 W. de W. Abney, Capt. R.E., F.R.S.
 G. W. Royston Pigott, M.A., M.D., F.R.S.
 Robert H. Scott, F.R.S., Director Meteorological Office.
 George Robert Stephenson, F.R.S., President Institute Civil Engineers.
 F. H. Wenham.
 George Bentham, F.R.S.
 Nevil S. Maskelyne, F.R.S.
 H. S. Eaton, President of the Meteorological Society.
 E. Atkinson, Treasurer of the Physical Society.
 F. A. Abel, F.R.S., President of the Chemical Society.
 T. Hawksley, President of the Institute of Mechanical Engineers, past President of the Institute of Civil Engineers.
 William H. Stone, F.R.C.P., &c.
 W. J. Russell, F.R.S.
 David Forbes, F.R.S.
 Richd. Collinson, Vice-Admiral, Deputy Master of the Trinity House.
 B. Woodcroft, F.R.S., late Superintendent of Patent Office Museum.
 C. W. Merrifield, F.R.S.
 Andw. C. Ramsay, F.R.S., Director General Geological Survey.
 C. P. B. Shelley.
 James Baillie Hamilton.
 F. Eardley-Wilmot, F.R.S., Major-General.
 Henry Cole.
 Warren De La Rue, F.R.S.
 Frederick Guthrie, F.R.S., Prof. Physics, Royal School of Mines.
 C. O. F. Cator.
 Thomas Savage.
 Alfred Barry, D.D., Principal of King's College.
 Wm. Chappell, F.S.A.
 A. J. Mundella, M.P.
 William C. Unwin, Prof. Engineering, Indian C. E. College.
 George T. Clark.
 Joseph Woolley, LL.D.
 John F. Twisden.
 Richard Strachey, Major-General, F.R.S.
 Frank Bolton.
 D. Glasgow.
 William Rutherford, M.D., F.R.S.
 Henry E. Roscoe, F.R.S.
 J. Hopkinson.
 A. W. Reinold.
 John Tyndall, F.R.S.
 John Torr, M.P.
 Aberdare, President of the Royal Horticultural Society.
 Robert James Mann, M.D.
 Albert Günther, V.P.R.S.

H. C. Rawlinson, F.R.S., late President Royal Geographical Society.
 W. B. Baskcomb.
 James K. Shuttleworth.
 Geo. Busk, F.R.S.
 Geo. J. Allman, F.R.S., President of the Linnean Society.
 J. Arthur Phillips.
 T. H. Huxley, Sec. R.S.
 E. Ray Lankester, F.R.S.
 H. C. Sorby, F.R.S., President of the Royal Microscopical Society.
 W. T. Thiselton Dyer, Assistant-Director, Royal Gardens, Kew.
 Henry W. Acland, F.R.S., President of Medical Council.
 H. W. Chisholm, Warden of the Standards.
 D. T. Ansted, M.A., Cant., F.R.S.
 J. H. Gladstone, F.R.S., Fullerian Professor, Royal Institution.
 J. Scott Russell, F.R.S.
 A. Lane Fox, Colonel, F.R.S.
 Rayleigh, F.R.S.
 Robert S. Ball, LL.D., F.R.S., Astronomer Royal, Ireland.
 H. C. Seddon, Major, R.E.
 Charles V. Walker, F.R.S., President of the Society of Telegraphic Engineers.
 Joseph Whitworth, F.R.S.
 G. Carey Foster, F.R.S., President of the Physical Society.
 Balfour Stewart, F.R.S.
 R. B. Clifton, F.R.S., Professor of Experimental Philosophy, Oxford.
 W. F. Barrett, Prof. Physics, Royal College of Science, Dublin.
 J. Norman Lockyer, F.R.S.
 Francis Galton, F.R.S.
 J. Cameron, F.R.S., Major-General, Director Ordnance Survey.
 M. Foster, F.R.S.
 E. A. Schäfer.
 B. Samuelson, M.P.
 E. Klein, F.R.S.
 W. N. Hartley.
 Francis Guthrie, LL.B.
 P. Martin Duncan, F.R.S., President of the Geological Society.
 P. L. Sclater, F.R.S.
 J. E. Davis, Capt. R.N., Hydrographic Department, Admiralty.
 H. Dent Gardner.
 John Allan Brown, F.R.S.
 William Hackney.
 Etrick W. Creak, Staff Commander, R.N.
 W. H. Preece.
 W. Chandler Roberts, F.R.S.
 A. B. Kempe, B.A., Barrister-at-Law, Western Circuit.
 Alex. Crum Brown, Professor of Chemistry, Edinburgh University.
 James Dewar, Professor of Mechanism, Cambridge.
 Urban Pritchard, M.D.
 R. H. M. Bosanquet, M.A., F.R.A.S., F.C.S., Fellow of St. John's College, Oxford.
 Sydney H. Vines.
 Alfred E. Fletcher.
 Herbert M'Leod, Prof. of Experimental Science, Indian C.E. College.
 Alex. B. W. Kennedy, C.E., Prof. Engineering, University College.
 Arch. Geikie, F.R.S., Director, Geological Survey, Scotland.
 Cornelius B. Fox, M.D., F.M.S.
 Nicholas Brady, M.A.
 Thomas Stevenson, F.R.S.E., F.G.S., M. Inst. C.E.
 John Jellett, D.D., F.R.S.
 Thomas Pigot, Prof. Engineering, Royal College of Science, Dublin.
 J. P. O'Reilly, Prof. Mineralogy and Mining, Royal College of Science, Dublin.

T. Lauder Brunton, M.D., F.R.S.
 J. E. H. Gordon.
 W. Galloway, Prof. Chemistry, Royal College of Science, Dublin.
 Henry E. Armstrong, F.R.S.
 Thomas Andrews, LL.D., F.R.S., President of the British Association.
 James Thomson Bottomley, M.A., F.R.S.E.
 W. F. Donkin.
 Claude R. Conder, Lieut. R.E.
 Charles E. De Rance, F.G.S., H.M. Geological Survey.
 Nathl. Barnaby, Chief Constructor of the Navy.
 W. Topley.
 J. Clerk Maxwell, F.R.S., Prof. of Experimental Physics in University of Cambridge.
 G. G. Stokes, Sec. R.S. Lucasian Professor, Cambridge.

NOTES

THE current number of the *Fortnightly Review* contains an article by Dr. Bridges, in which he tries to prove that Harvey did not discover the circulation of the blood by vivisection. Harvey's own statements are so explicit, and the methods he employed have been so often expounded, that there is little new to be said on the point. Harvey, as Dr. Bridges admits, discovered the true functions of the heart, and inferred the existence of the complete systemic circulation by observations on living animals, interpreting the facts observed by aid of the faculty of reasoning. Malpighi demonstrated the capillary part of the circulation by other observations on living animals, dealing with his new facts by aid of the same faculty. But to say that the movements of the heart were discovered by vivisection and the brains of Harvey, but the circulation of the blood "by the microscope of Malpighi" is as absurd as to ascribe the glory of the former discovery to Harvey's scalpel and that of the other to Malpighi's brains.

THE following are the numbers of visitors to the Loan Collection of Scientific Apparatus during the week ending July 15:—Monday, 3,464; Tuesday, 3,300; Wednesday, 602; Thursday, 495; Friday, 451; Saturday, 3,403; total, 11,715. During the present week 13 demonstrations of apparatus were given on Monday, 11 on Tuesday, 5 on Wednesday; 6 are to be given to-day, 5 on Friday, and 5 on Saturday.

THE annual meeting of the Helvetic Society of Natural Sciences will take place at Basle, on August 20-23. Scientific men of all countries are cordially invited to the meeting; and those who wish to make any communication are requested to write, before August 1, to Dr. H. Christ, 5, Bäunleingasse, Basle.

THE Scientific Societies of Belgium held their first united Congress at Brussels this week, from the 16th to the 18th. The following, we learn from the *Society of Arts Journal*, are some of the subjects which have been discussed:—Greater facilities for the transmission of scientific objects; as to the opening of public scientific institutions at convenient hours, and especially in the evening; the organisation of libraries and scientific collections in the towns and communes; the publication of elementary treatises on various branches of science; establishment at one of the littoral towns of a collection of works concerning the coast; a study of the geological formation of the district round Brussels; the part played by molluscs in nature; the malacological zones of Belgium. On the 18th there was to be a scientific excursion into the environs of Brussels.

AT a meeting of the Council of the Yorkshire College of Science, held last Friday, an offer by Mr. George Salt, of 150*l.* a year for three years as a temporary provision for a professorship of Biology, was accepted, Mr. Salt's stipulation that Mr.